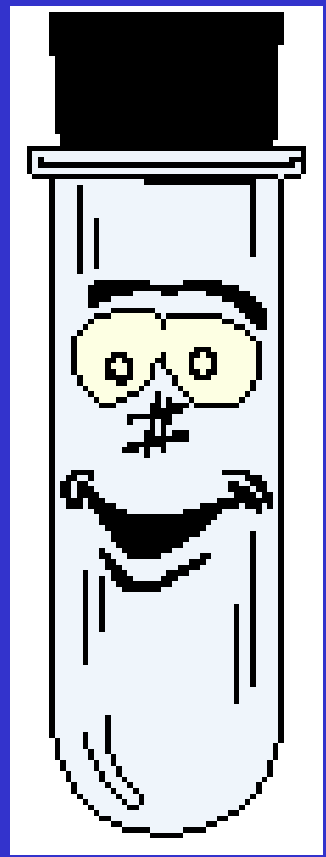
Biotechnology
An Overview

What is Biotechnology?

Biotechnology uses "cutting-edge knowledge and techniques from the life sciences to create commercial products and services"



Note: Happy Test Tube, Not Mr. Peanut

Biotech - A Brief Timeline

8000 B.C. Humans domesticate crops and livestock

4000-2000 B.C. Yeast harnessed to leaven bread and ferment beer

1866 Gregor Mendel shows patterns of inheritance

1953 Watson and Crick discover the double-helix structure of DNA

1973 Recombinant DNA techniques developed

1974 Monoclonal Antibodies created

1983 PCR method of amplifying DNA invented

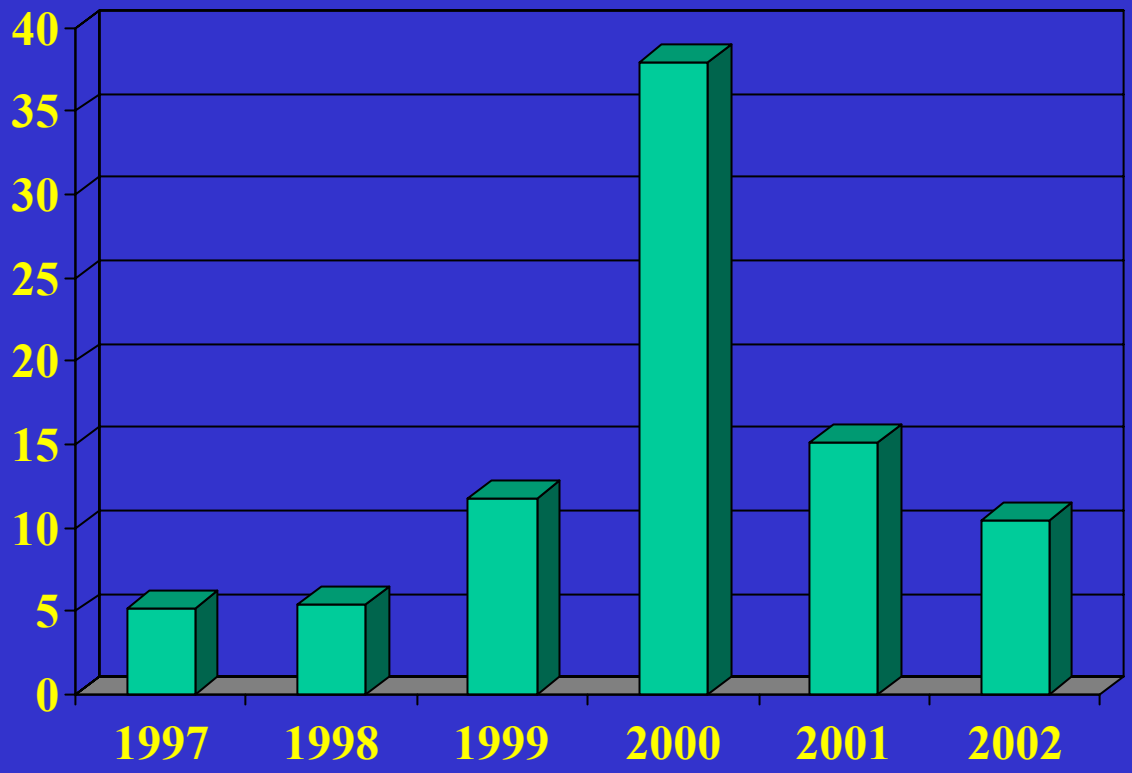
1997 Dolly the sheep first mammal cloned

1998 Researchers first grow human embryonic stem cells.

2000 The rough draft of the human genome DNA sequence is completed.

Biotech - Boom, Bust, Boom?

Total Financing, 1997-2002
(in U.S. dollars in billions)



Source: BioWorld

Biotech - After the Boom

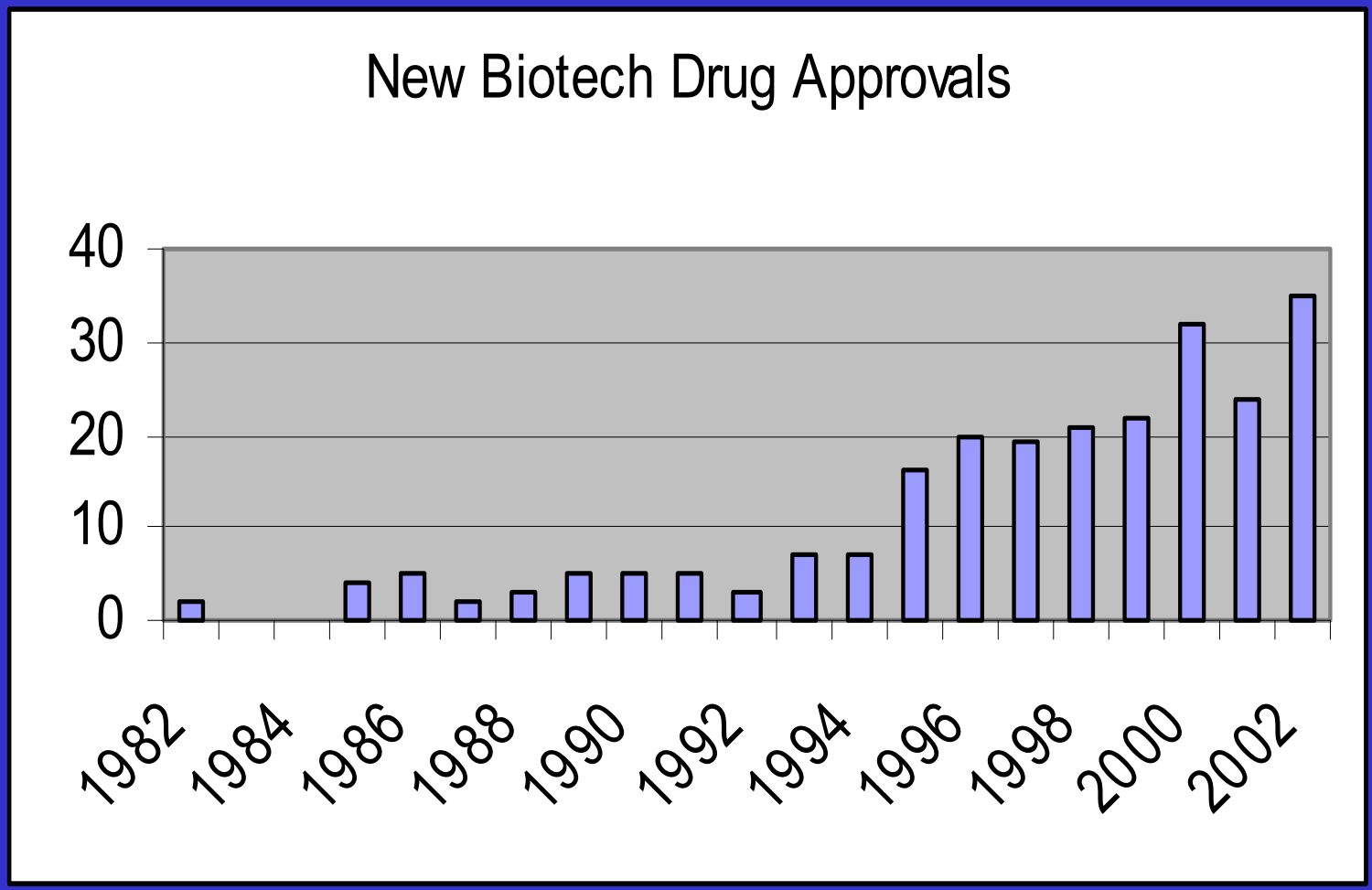
Biotech continues to expand in California despite slow economic recovery

Major centers: San Diego, LA/Orange, Bay Area, Central Valley

35% of the Nation's 1300 Biotech firms are in California

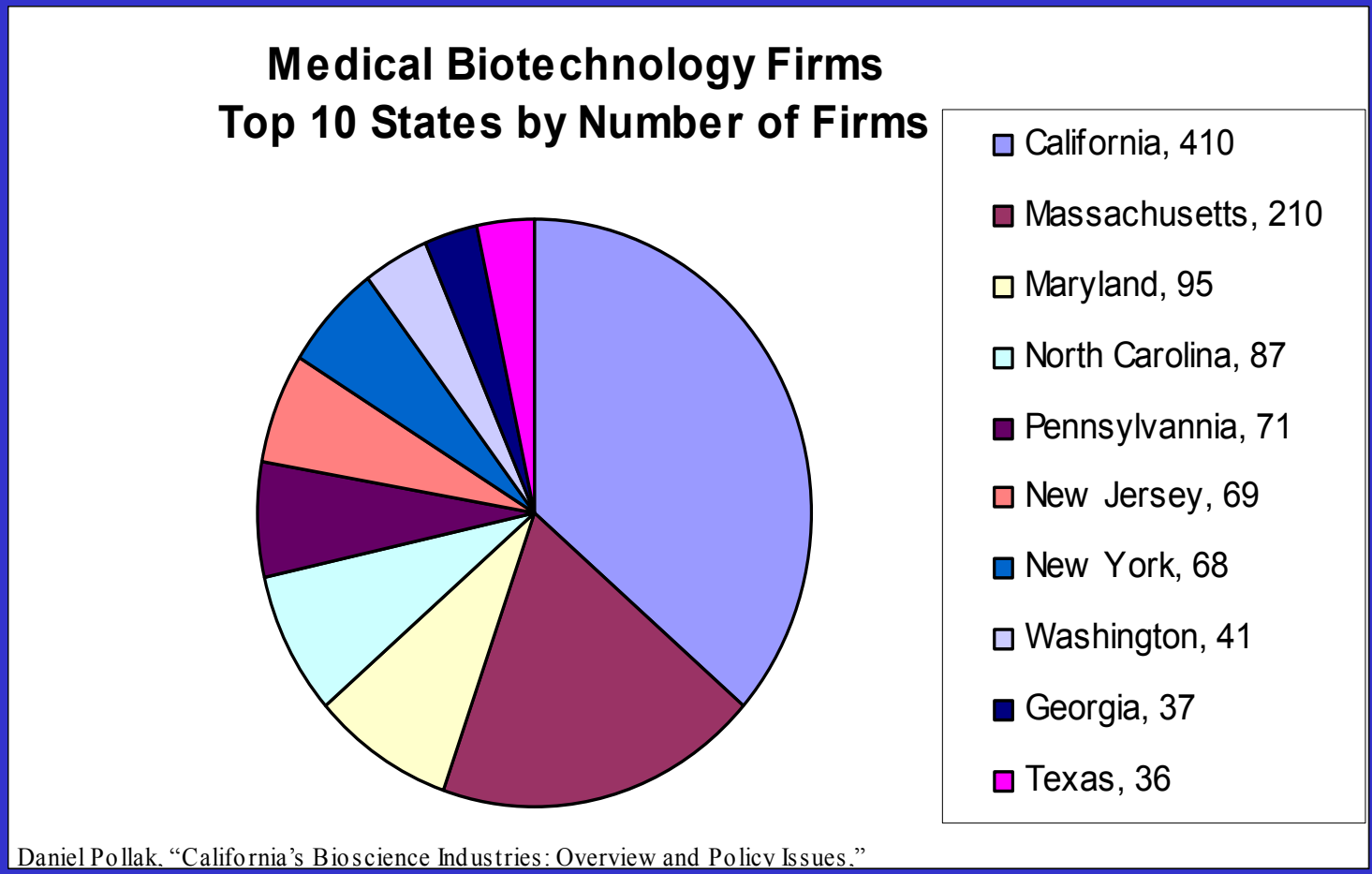
Biotech jobs are projected to grow 30% from 2000 to 2010, adding 219,000 jobs

Steady Growth in Drug Approvals



Source: Biotechology Industry Organization

Biotech by State - 2002

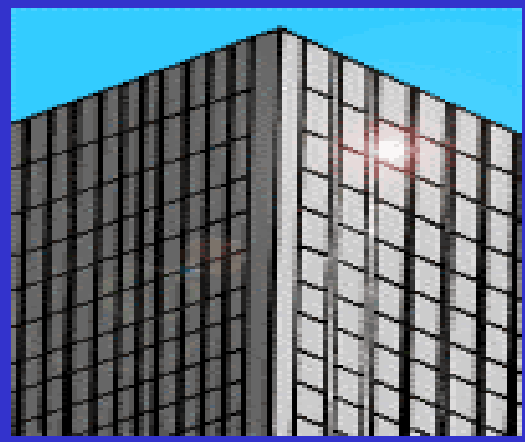


Daniel Pollak, "California's Bioscience Industries: Overview and Policy Issues."

Biotech: A Changing Industry

Then:

Drug Research and Development Done by Pharmaceutical Companies



Now:

Drug Discovery is Increasingly Done By Smaller Biotech Firms

Biotech Employment Found Across Many Industries

Existing Industry Classification Systems don't fit biotech to a 'T'

As a result, Biotech employment is found in a variety of industries, including:

- Drugs
- Measuring and Controlling Devices
- Medical Instruments and Supplies
- Professional & Commercial Equipment
- Drugs, Proprietaries, and Sundries
- Medical and Dental Laboratories
- Engineering and Architectural Service
- Research & Testing Services
- Management and Public Relations

Major Occupational Classifications In Revised Guide

Research and Development Occupations

Clinical Research

Manufacturing and Production

Regulatory Affairs

Quality Systems

Information Systems

Sales and Marketing

Occupations Covered in the Biotech Guide

Animal Handlers
Animal Technicians
Assay Analysts
Biochemical Development Engineers
Bioinformatic Specialists
Biostatistician
Clinical Research Associates
Customer Service Representatives
Documentation Coordinators
Greenhouse Assistants
Instrumentation/Calibration Technicians
Laboratory Assistants
Laboratory Support Workers
Library Assistants
Manufacturing Engineers
Manufacturing Research Associates
Manufacturing Technicians
Microbiologists
Plant Breeders
Process Development Associates
Process Development Engineers
Production Planners
Quality Assurance Auditors
Quality Control Analysts
Quality Control Engineers
Quality Control Inspectors
Research Associates (R&D)
Safety Specialists
Sales Representatives
Scientific Programmer Analysts
Scientists
Technical Service Representatives
Technical Writers
Validation Technicians

Occupations Common to Biotech and Other Industries

Often require a higher level of education and longer period of experience in the Biotech Industry.

Keeping Biotech in California

80% of states and cities have listed biotech as one of their top targets for development. Ten States have added Biotech to their strategic development plans

Iowa plans to spend $500 million over five years to develop biotech and other industries. Missouri will spend $117 million to grow the sector. Tennessee and New Mexico are both looking to attract Biotech

There are some risks. It has estimated it takes 15 years for companies to turn a profit -- if they survive -- and estimates of the industry's overall losses have approached $6 billion. Industry gyrations are not uncommon.

The top five biotech clusters -- Boston, San Francisco, San Diego, Seattle and Raleigh-Durham, N.C. -- accounted for three-fourths of biotech venture capital over the past six years.

The Future

In spite of ups and downs, Biotech remains a clean industry that pays good salaries.

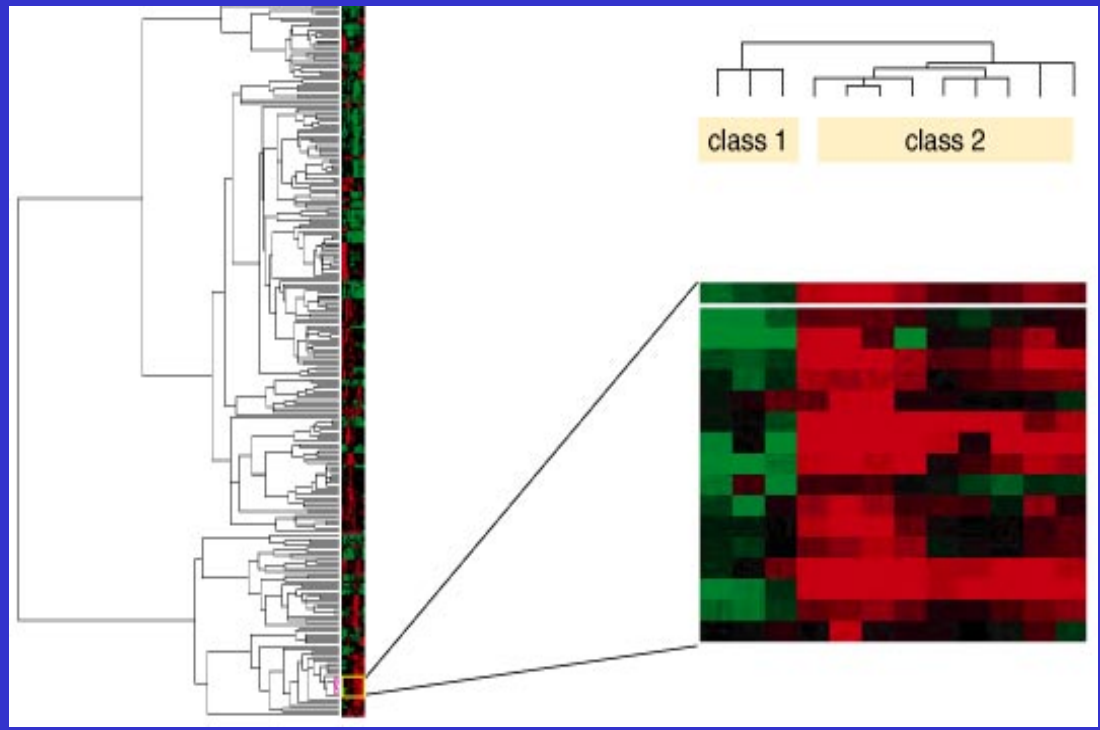
The challenge is to meet the demands of the industry in terms of qualified employees who have the necessary skills and background.

California is the largest employer and the home of the most companies With attentiveness to the changing dynamics of the industry, it will likely remain so over the near term, at least.

Gene Chips

The red and
green colors represent
whether a gene is
expressed or active in
a sample.

Sales of these chips is
over ½ million per year



Proteomics*
The Study of the Form and Function of Proteins

After the Genome comes the proteome

Deciphering the human genome took about 10 years, identifying about 40,000 genes.

Doing the same with the up to 1,000,000 proteins may take 50-100 years.

* -ome Derived from genome, it has come to mean "any collection or aggregation of similar biological entities"

New Targets Against Heart Disease

Several drugs now under study to treat cardiovascular disease

Drugs to increase HDL (good) cholesterol level

Infusion of Stem Cells directly into the heart to help grow new blood vessels

Gene Therapy to Correct Acquired or Inherited Heart Disease

The War on Cancer – A Timeline

- 1971 President Nixon Declares War on Cancer
- 1974 Monoclonal Antibodies Developed
- 1990 First Successful Gene Therapy Treatment
- 1998 Cancer Vaccines Reach Clinical Trials
- 2001 Anti-Growth Signal Treatment Approved

Other Biotech Targets

Diabetes – Closing in on a Cure?

Regeneration of Nerves – Is It Possible?

Infectious Diseases – The Battle Continues

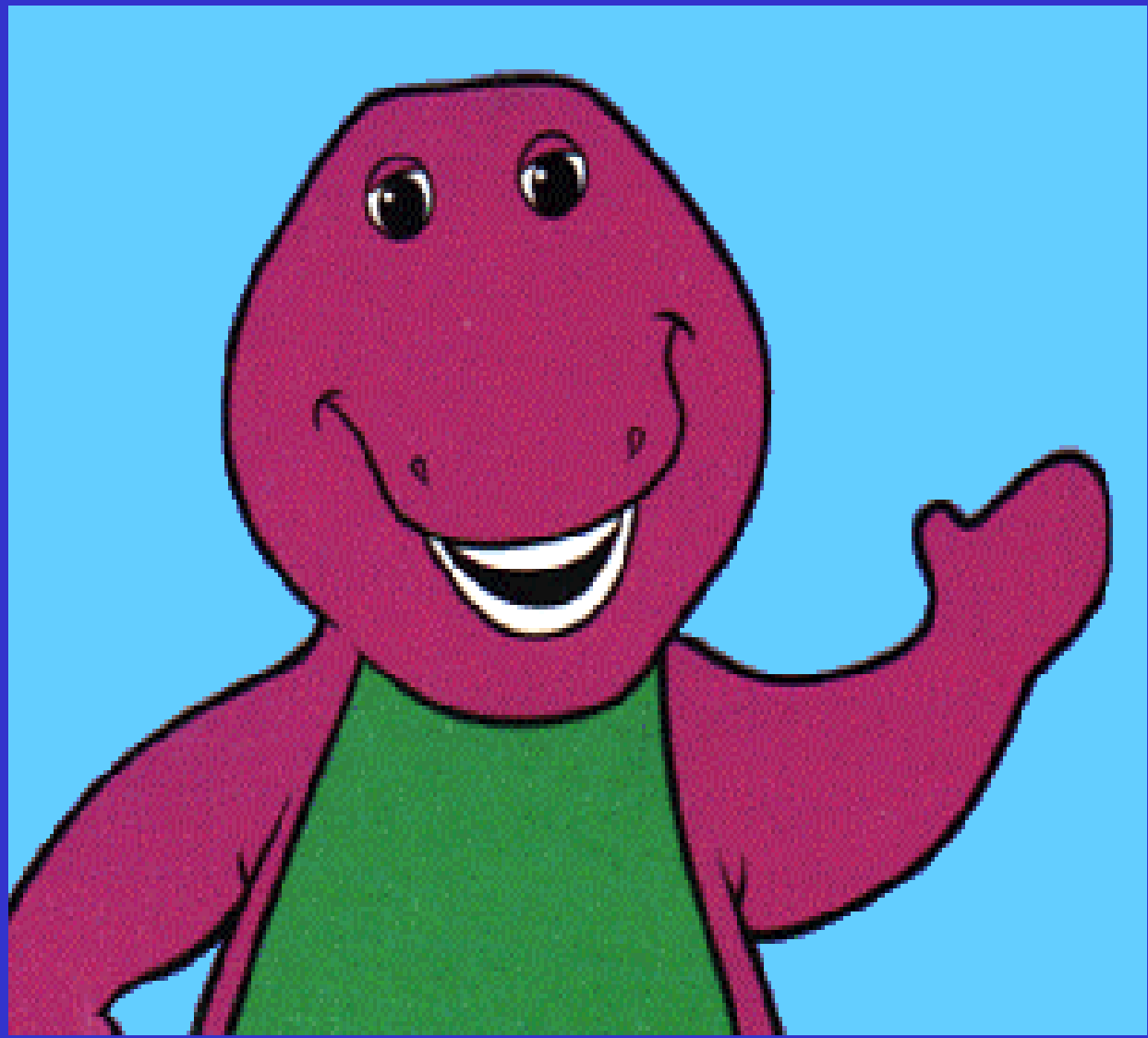
Cloning

Two Types of Cloning:

Therapeutic Cloning – To Cure Disease

Reproductive Cloning – To Create New Life

Could Jurassic Park Happen?



Biotech - Industry and Occupations

Industries Include:

Drugs, Veterinary Medicine, Agricultural Products,
Medical Instruments, Supplies, Medical and Dental Laboratories,
Laboratory Equipment, Engineering Services, and Research and Testing Services.

Occupations Include:

Engineering, Chemistry, Biochemistry, Market Research and Sales, Clerical,
Manufacturing and Assembly, Quality Control, Regulatory Affairs
and a wide range of Technicians including Biological, Chemical and
Medical and Clinical Laboratory Technicians.